

## CLAIMS

1. A cell-filled device of a modified cross-section hollow fiber membrane type, comprising hollow fiber membranes whose hollow portions are filled with cells, characterized in that:

the hollow fiber membranes have modified cross sections; and

a cell aggregate provided in each of the hollow portions has cells formed into two or more layers in arbitrary directions, provided that a distance from an arbitrary point of the cell aggregate to the nearest inner wall of the hollow fiber membrane is less than 75  $\mu\text{m}$ .

2. A cell-filled device of a modified cross-section hollow fiber membrane type according to claim 1, wherein the distance to the nearest inner wall of the hollow fiber membrane is 50  $\mu\text{m}$  or less.

3. A cell-filled device of a modified cross-section hollow fiber membrane type according to claim 1 or 2, characterized in that a cross-section of the modified cross-section hollow fiber membrane is in a flat form.

4. A cell-filled device of a modified cross-section hollow fiber membrane type according to any one of claims 1 to 3, characterized in that a pore size of the hollow fiber membrane is

0.001 to 5  $\mu\text{m}$ .

5. A cell-filled device of a modified cross-section hollow fiber membrane type according to claim 4, wherein the pore size is 0.05 to 1  $\mu\text{m}$ .

6. A cell-filled device of a modified cross-section hollow fiber membrane type according to any one of claims 1 to 5, characterized in that the hollow fiber membrane is made of a synthetic polymer having a contact angle of 70 degrees or less.

7. A cell-filled device of a modified cross-section hollow fiber membrane type according to claim 6, wherein the synthetic polymer comprises a thermoplastic resin.

8. A cell-filled device of a modified cross-section hollow fiber membrane type according to claim 7, wherein the thermoplastic resin comprises a polyethylene-based resin.

9. A cell-filled device of a modified cross-section hollow fiber membrane type according to any one of claims 1 to 8, characterized in that at least an inner surface of the hollow fiber membrane contains a hydrophilic polymer.

10. A cell-filled device of a modified cross-section hollow fiber membrane type according to any one of claims 1 to 9, characterized in that the cells comprise cells derived from an animal tissue.

11. A cell-filled device of a modified cross-section hollow fiber membrane type according to claim 10, characterized in that the cells derived from an animal tissue comprise at least one kind of cell selected from the group consisting of cells derived from a liver, cells derived from a spleen, stem and precursor cells thereof, and genetic recombinant cells.

12. A cell-filled device of a modified cross-section hollow fiber membrane type according to claim 11, characterized in that the cells derived from an animal tissue comprise hepatic cells.

13. A cell-filled device of a modified cross-section hollow fiber membrane type according to any one of claims 10 to 12, wherein the cells derived from an animal tissue comprise cells derived from a human organ.

14. A cell-filled device, comprising hollow fiber membranes and cells, provided as the cell-filled device of a modified cross-section hollow fiber membrane type for implantation according

to any one of claims 1 to 13, wherein each of the hollow portions contains a cell aggregate and both ends of each hollow fiber membrane are sealed.

15. A cell-filled device of a modified cross-section hollow fiber membrane type for a hybrid artificial organ, which is one according to any one of claims 1 to 13.

16. A hybrid artificial organ, comprising at least one cell-filled device of a modified cross-section hollow fiber membrane type according to any one of claims 1 to 13.

17. A hybrid artificial organ, comprising at least one cell-filled device of a modified cross-section hollow fiber membrane type according to any one of claims 1 to 13, being housed in a container having an inlet and an outlet for a liquid to be treated, characterized in that an inside of a hollow of the cell-filled device of a modified cross-section hollow fiber membrane type is separated from an external of the hollow forming a communication path of the liquid to be treated.

18. A method of manufacturing a cell-filled device of a modified cross-section hollow fiber membrane type, comprising the steps of:

a) obtaining a modified cross-section hollow fiber membrane;  
and

b) injecting a cell suspension into a hollow of the hollow fiber membrane.

19. A method of manufacturing a cell-filled device of a modified cross-section hollow fiber membrane type according to claim 18, further comprising the step of producing the hollow fiber membrane using double annular spinning nozzle having a modified cross section.

20. A method of manufacturing a cell-filled device of a modified cross-section hollow fiber membrane type according to claim 18, further comprising the step of applying an external force for deformation to a hollow fiber membrane not having a shape of interest in an approximately vertical direction of its fiber axis to obtain the modified cross-section hollow fiber membrane.

21. A method of manufacturing a cell-filled device of a modified cross-section hollow fiber membrane type according to claim 18, further comprising the step of drafting the hollow fiber membrane not having a shape of interest in the direction of its fiber axis while deforming the shape of the cross section to mold the membrane into the modified cross-section hollow fiber membrane.

22. A method of manufacturing a cell-filled device of a modified cross-section hollow fiber membrane type according to any one of claims 18 to 21, characterized in that the cross section of the modified cross-section hollow fiber membrane is in a flat form.

23. A method of manufacturing a cell-filled device of a modified cross-section hollow fiber membrane type according to any one of claims 18 to 22, characterized in that a material of the hollow fiber membrane comprises a thermoplastic resin.

24. A method of manufacturing a cell-filled device of a modified cross-section hollow fiber membrane type according to any one of claims 18 to 23, characterized in that injected cells comprise cells derived from an animal tissue.

25. A method of manufacturing a cell-filled device of a modified cross-section hollow fiber membrane type according to claim 24, characterized in that the cells derived from an animal tissue comprise at least one kind of cell selected from the group consisting of cells derived from a liver, cells derived from a spleen, stem and precursor cells thereof, and genetic recombinant cells.

26. A method of manufacturing a cell-filled device of a

modified cross-section hollow fiber membrane type according to claim 25, characterized in that the cells derived from an animal tissue comprise hepatic cells.

27. A method of manufacturing a cell-filled device of a modified cross-section hollow fiber membrane type according to any one of claims 24 to 26, characterized in that the cells derived from an animal tissue comprise cells derived from a human organ.

28. A method of manufacturing a hybrid artificial organ comprising the method of manufacturing a cell-filled device according to any one of claims 18 to 27.

29. A method of manufacturing a hybrid artificial organ characterized in that:

at least one modified cross-section hollow fiber membrane used in the method of manufacturing a cell-filled device according to any one of claims 18 to 27 is housed in a container having an inlet and an outlet for a liquid to be treated, and an injection opening for cells; and

potting is performed such that an inside of a hollow is communicated with the injection opening for cells and separated from an external portion of the hollow, followed by injecting cells into hollow portions to form a cell aggregate.